Discussion and Exception Handling in Financial Forecasting

# 1. Introduction

This document discusses the purpose, logic, and exception handling mechanism in a Java-based financial forecasting system. The system aims to predict future financial values based on a base amount, growth rate, and target year.

# 2. Purpose of Financial Forecasting Code

The purpose of the financial forecasting code is to estimate the future value of an investment using a compound interest-like formula. It takes into account a base amount, a fixed annual growth rate, and a target future year.

# 3. Key Components and Workflow

Key Classes Involved:

* - FinancialForecast.java: Contains core logic for forecasting and validation.
* - FinancialForecastTest.java: Contains the main method and test cases for various scenarios.

Workflow Summary:

1. Instantiate FinancialForecast.  
2. Set a base amount and target future year.  
3. Call `predictFutureValue()` to compute the result.  
4. Handle exceptions for invalid growth rates and past years using try-catch blocks.

# 4. Exception Handling in the Code

The system uses `IllegalArgumentException` to validate inputs. Exception handling is implemented to manage and gracefully handle invalid cases:

* - Invalid Growth Rate (e.g., negative or >100%)
* - Invalid Year (e.g., year less than or equal to current year)
* - Invalid Base Amount (e.g., negative or zero)

# 5. Code Output Explanation

The output indicates successful prediction when valid inputs are provided. For invalid values, the exception message is printed.  
Example Output:  
- Predicted value in 2040 for initial amount 12000.00 with 5.00% growth: 24947.14  
- Growth rate check passed: Growth rate must be between 0% and 100%  
- Year validation check passed: Year must be in the future.  
- Initial value check passed: Initial amount cannot be negative.

# 6. Conclusion

The financial forecasting system is robust due to built-in validation and structured exception handling. This ensures the program handles both valid and invalid scenarios appropriately.

# 7. Forecasting Formula Used

The financial forecast uses a formula similar to compound interest to estimate future value:  
  
 Future Value = Present Value × (1 + r)^n  
  
Where:  
- Present Value: Initial base amount  
- r: Annual growth rate (as a decimal)  
- n: Number of years between the current year and the future target year  
  
This formula compounds the growth over each year, meaning the value grows exponentially based on the rate and time period.

# 8. Time Complexity Analysis

The time complexity of the forecasting function is:  
  
 O(1) - Constant Time  
  
This is because the formula only performs basic arithmetic operations regardless of the size of the input. There are no loops or recursive calls. All calculations are performed in constant time.